

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
25 January 2001 (25.01.2001)

PCT

(10) International Publication Number
WO 01/05519 A1

(51) International Patent Classification⁷: B05D 5/06,
B05C 19/04

(21) International Application Number: PCT/NZ00/00127

(22) International Filing Date: 17 July 2000 (17.07.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
336795 16 July 1999 (16.07.1999) NZ

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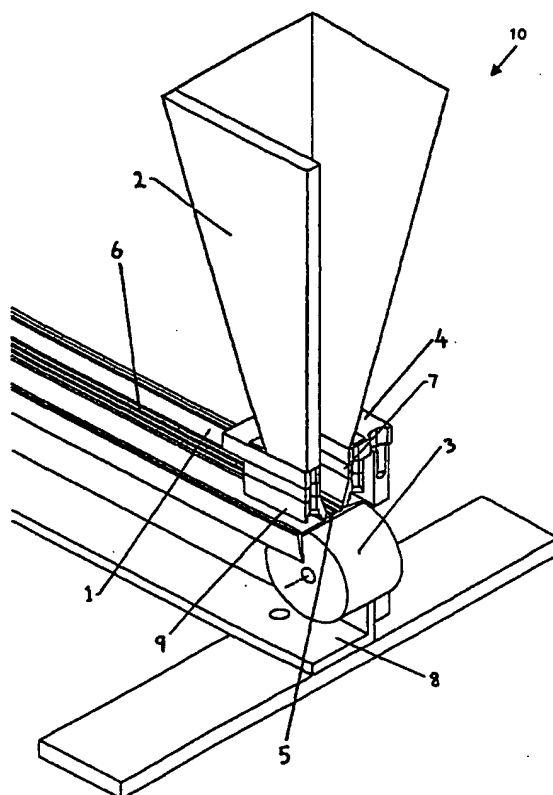
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(81) Designated States (national): AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

[Continued on next page]

(54) Title: PHOTO-LUMINESCENT PIGMENT APPLICATION



(57) Abstract: A method of applying photo-luminescent pigment to a substrate, such as an aluminium or metal strip containing channels or depressions, includes preparing a dry powder formulation comprising a photo-luminescent pigment and a carrier/fixer, depositing the dry powder formulation onto the substrate surface, and heating to fuse the dry powder formulation to the substrate surface. The photo-luminescent pigment can be applied using an apparatus which includes a hopper adapted to contain the dry powder formulation, one or more orifices adapted to allow transfer of the dry powder formulation from the hopper to a substrate surface and a guide rail system for locating the substrate surface in both a fixed horizontal plane and a fixed vertical plane below the hopper and orifice.

WO 01/05519 A1



(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Photo-Luminescent Pigment Application

Field of the Invention

The invention relates to a method and apparatus for applying photo-luminescent pigment to a substrate surface, more particularly for applying photo-luminescent pigment to aluminium or other metal strips used, for example, as stair nosings. The invention also relates to a product produced by said method and apparatus.

Background to the Invention

10 Low level floor or walkway lighting is commonly used in such places as picture theatres, sports arenas and aircraft as both a courtesy and safety feature for patrons or passengers. This lighting often takes the form of an electrical or electronic lighting means in or on the floor along either side of a walkway or across the nosing of stairs. Low level floor lighting is particularly important in picture theatres and sports arenas
15 where patrons may be required to negotiate steps in aisles when only low levels of ambient light are present, or in stairwells of buildings during an emergency when there may be failure of the main lighting source.

Known methods of floor lighting using electrical or electronic means have a
20 disadvantage because they require electrical wiring to be run to areas where access for the wiring may be limited. They are also prone to failure during failure of the main power supply. Additionally, the electronic lighting means are often of a low voltage type requiring some form of voltage reduction means such as an inverter, converter, or transformer. Not only does addition of this equipment add to the

- 2 -

complexity and cost of the installation but also provides for additional modes of failure.

It is known to apply a photo-luminescent pigment to a rope, tape or fabric. This
5 photo-luminescent pigment is stimulated by visible light and remains luminescent for
a considerable period after the light source is removed. The problem with tape or
fabric impregnated with pigment is that lacks durability for heavy wear areas such as
walkways or stairs.

10 Photo-luminescent pigment has been sprayed onto more durable substrate surfaces
such as aluminium or metal strips or extrusions. Once the spray has dried, it is
ground to provide a smooth finished surface. This overcomes the abovementioned
problems associated with heavy wear areas, but considerable pigment is wasted
during the spraying and grinding process.

15

Accordingly it is an object of the present invention to provide a method and
apparatus for applying photo-luminescence pigment to a substrate which avoids or
overcomes some of the abovementioned disadvantages, or which at least provides
the public with a useful choice.

Summary of the invention

According to a first aspect of the invention there is provided a method of applying photo-luminescent pigment to a substrate, said method including:

- 5 preparing a dry powder formulation comprising, at least, a photo-luminescent pigment and a carrier/fixer;
- depositing the dry powder formulation onto a substrate surface;
- heating the dry powder formulation to fuse it to the substrate surface.
- 10 Preferably the substrate surface has depressions or channels adapted to receive the dry powder formulation.

Preferably a light reflecting layer is applied to the substrate surface before depositing the dry powder formulation.

15

- Preferably the volume ratio of photo-luminescent pigment to carrier/fixer in the dry powder formulation is such that the fused material exhibits substantially the same strength and durability properties of the carrier/fixer, while still exhibiting the photo-luminescent properties of the pigment. More preferably the volume ratio is
- 20 substantially in the range of 1% to 35% photo-luminescent pigment to carrier/fixer.

Preferably the dry powdered formulation may be heated to between, substantially, 160 to 210 degrees centigrade, or to a temperature recommended by the manufacturer of

- 4 -

the carrier/fixer, for approximately 10 to 20 minutes or until the formulation is molten. The molten formulation may be cooled after heating.

Preferably the carrier/fixer is a heat curable polymer.

5

Preferably the dry powder formulation may include small quantities of additives, such as a de-gassing additive, to ensure a smooth surface finish.

Preferably the substrate is stamped, extruded or milled aluminium or metal.

10

According to a second aspect of the invention there is provided an apparatus for applying photo-luminescent pigment to a substrate, said apparatus including:

a hopper adapted to contain a dry powder formulation;

one or more orifices adapted to allow transfer of the dry powder formulation

15

from the hopper to a substrate surface; and

a guide rail system for locating the substrate surface in both a fixed horizontal plane and a fixed vertical plane below the hopper and orifice.

Preferably the apparatus also includes a heat-curing system for providing enough heat
20 to turn the dry powder formulation into a molten mix.

Preferably the apparatus also includes a cooling system to cool the molten mix.

- 5 -

Preferably the apparatus also includes a drive system to move the substrate through the apparatus.

Preferably the apparatus includes a support roller mounted directly beneath the
5 orifice(s) and hopper to support the substrate.

Preferably the apparatus includes an adjustable mounting bracket adapted to enable the hopper to be located in the correct position so that the orifice(s) lines up with the substrate.

10

Preferably the orifice is adapted to communicate snugly with the substrate surface such that the dry powder formulation is deposited substantially only where required.

Preferably the apparatus includes a mechanism for tapping the hopper so that any
15 rat-holes in the dry powder formulation are re-filled.

Preferably the apparatus includes a brush mounted below the roller, and with its bristles in contact with the roller, so that any powder that falls onto the roller is subsequently brushed off.

20

The heat-curing system may be an oven. Optionally, the heat-curing system may be a continuous oven process, and in one embodiment may include infra-red heating elements.

- 6 -

Preferably the apparatus includes an automatic loading and unloading means at each end thereof.

The invention also provides for a product when produced according to the process, or
5 by an apparatus, herebefore defined.

Further aspects of the invention will become apparent from the following description which is given by way of example only.

10 **Brief Description of the Drawings**

An example of the invention will now be described with reference to the accompanying drawings in which:

FIGURE 1: illustrates a perspective cross section view through a hopper according to the invention; and

15 **FIGURE 2:** illustrates an elevation view of the hopper and a feed table; and,

FIGURE 3: illustrates a schematic overview of one embodiment of an apparatus according to the invention.

Description of the Invention

20 The invention provides for a method and apparatus for applying photo luminescent pigment, which is stimulated by UV and visible light and will remain illuminated for a period after the light source is removed, to a substrate such as aluminium or metal strips. The resulting substrate can be used to provide floor, stair or other courtesy or emergency lighting in public areas.

- 7 -

The process involves filling depressions or channels in a substrate material (typically, but not exclusively, an aluminium extrusion or stamped or milled sheet of aluminium) with a dry powder formulation that contains a photo luminescent pigment; a
5 carrier/fixer (typically a heat curable polymer); and preferably small quantities of additives (such as a flow additive and/or de-gassing additive) that improve the melt properties of the mix and ensure a smooth surface finish. Sufficient heat is applied to the combined formulation to melt and cure it, and when cooled it fuses to itself and to the substrate.

10

In order to improve the effectiveness of the photo-luminescent formulation a light reflective layer can be applied to the substrate before depositing the formulation.

The depressions or channels in the substrate are filled up with the dry powder
15 formulation to be level with the top surface of the substrate material. When the formulation becomes molten the air between the particles is expelled and the subsequently fused material forms a thick film that smoothly covers both the horizontal and vertical surfaces of the depressions or channels in the substrate. Because the surface of the fused formulation is lower than the highest point of the
20 depressions or channels it is protected from wear and is suited to use in floor illumination situations.

While a number of products suitable for such a photo-luminescent formulation may be apparent to a skilled addressee, the products used in the current invention are

- 8 -

LUMINOVA, a photo-luminescent pigment from Nemoto Japan; and TPE, a carrier/fixer produced by Dulux New Zealand. The flow and de-gassing additives are also produced by Dulux New Zealand.

- 5 The ratio of photo-luminescent pigment to carrier/fixer in the dry powder formulation is dependent on the intensity and duration of illumination desired. If greater intensity and duration of illumination is desired, more pigment is added. A typical formulation will contain between 30% and 60% photo luminescent pigment powder by weight. However, because the specific gravity of the powder is typically 3-4 times greater
10 than the rest of the dry powder formulation, the photo luminescent pigment volume ratio is typically in the range 10% to 30%.

- Because the photo-luminescent pigment makes up a relatively small part of the total volume of the fused material the fused material exhibits substantially the same
15 strength and durability properties that the carrier/fixer would have without the inclusion of the photo luminescent pigment, but it also has the added property of being photo-luminescent. Success has been achieved with volume ratios between 1% and 35% photo-luminescent pigment.

- 20 The principle of the process is to pass the substrate material, with the channels or depressions facing upwards, below a hopper which is filled with the dry powder formulation. The hopper has one or more bottom orifices which is shaped so that the dry powder formulation will fall under its own weight into the channels or depressions and will not spill on either side of the substrate. As the substrate passes

- 9 -

under the hopper the lower surface of the bottom orifice(s) wipe the top surface of the substrate material clean so that the only dry powder formulation that is removed from the hopper is that which fills the channels or depressions. The channels or depressions are filled to be level with the top surface of the substrate. Heat is then
5 applied to cure the dry powder formulation. After heating the formulation may be cooled.

Individual pieces of the substrate material are successively passed underneath the hopper in such a way that no substantial quantities of the dry powder formulation fall
10 between the tail end of one piece and the lead edge of the subsequent piece.

Figures 1 and 2 illustrate, in detail, the hopper section 10 of an apparatus for applying photo luminescent material to a substrate. Figure 3 illustrates a schematic overview (not to scale) of the whole apparatus, each aspect of which will now be
15 described.

The apparatus includes a guide rail system 8 for locating the individual substrate pieces, in this case aluminium extrusion 1, in both a fixed horizontal plane and a fixed vertical plane.

20

A drive system is used to push individual substrate pieces passed (below) a hopper 2. This drive system may be a human operator, or it may be a system of motorised rollers 11 that engage with one or two faces of the individual substrate pieces. Also, support roller 3 may be motorised to drive the extrusion 1 below hopper 2. In an

- 10 -

automated embodiment of the apparatus the motorised rollers 11 and 3 may be operated from a variable speed motor drive which may interface with a controller.

The hopper section 10 comprises the hopper 2, preferably with steep sides to avoid build-up of product, that might hold typically, but not exclusively, 1-1.5 kg of dry powder formulation. The hopper 2 shown in Figure 1 is cut-away for illustration purposes.

An adjustable mounting bracket 4 may also be included to enable the hopper 2 to be located in the correct position so that a bottom orifice 5 lines up with the channels or depressions 6 in the extrusion 1. Orifice 5 may be formed in a die 9, which is adapted to suit the extrusion 1 being used. The die 9 would butt snugly over extrusion 1 so that no formula was spilled or wasted. Various dies may be interchangeable to provide for different substrates. The dies may have more than one orifice - for example a two orifice die for a two channel or depression substrate.

There is a compressible foam rubber insert 7 between the hopper body 1 and the bottom orifice 5, which suspends the bottom orifice 5 in such a way that it will still seal against the extrusion 1 even if the extrusion 1 is not perfectly lined up with the hopper 2.

A support roller 3 mounted directly beneath the bottom orifice 5 of the hopper 2 to support the extrusion 1 without imposing excessive friction. This allows the extrusions 1 to be readily moved through the system. Roller 3 may be motorised but

- 11 -

this is not essential as its main function is to hold the extrusion up to the orifice 5. A bristle brush (not shown) may be mounted directly below the roller 3, with its bristles in contact with the roller, so that any powder that falls onto the roller is subsequently brushed off and will not to build up on the roller 3.

5

A mechanism (not shown) for tapping the hopper 2 at regular intervals can be provided so that any "rat-holes" in the dry power are re-filled. Typically the tapping action will occur once every 30-60 seconds of operation, which is not enough to allow the different components of the dry powder formulation to separate
10 substantially. In its simplest form this "mechanism" may in fact be the hand of a human operator, but ideally this function is carried out by a solenoid or air actuated arm. Alternatively an auger or screw may be included which either continuously or intermittently "mixes" the formula, thereby filling any "rat holes".

15 The apparatus also includes a heat-curing system, for example an oven, 12 to provide enough heat to melt and cure the dry powder formulation, and bond it to the substrate. This could be an oven with a rack system. After the individual substrate pieces have had their channels or depressions filled with the dry powder formulation they are loaded by hand onto the racks. When the racks are full the racks are placed
20 in the oven for the required time. Using this system a typical curing cycle may be 10-20 minutes at 160°C to 200°C.

In an automated apparatus the oven would most preferably be a continuous tunnel process so that after the individual substrate pieces have had their channels or

- 12 -

depressions filled with the dry powder formulation they immediately enter a curing tunnel 12 that rapidly heats them to typically 160°C to 200°C for a sufficient time to turn the dry powder formulation into a molten mix and bond it to the substrate. The individual substrate pieces then emerge from the opposite end of the tunnel. A
5 cooling tunnel 13 may also be provided.

The curing tunnel could be either a hot-air type oven or an infra-red oven. At present the applicant has found that the hot-air type oven produces the best result. However, infra-red ovens provide a much faster and more direct heating method.
10 The problem with infra-red ovens is that the rapid localised heating causes distortion of the substrate material. The degree of distortion is dependent on the form and type of substrate material. It is envisaged that with improvements in infra-red heating technology and substrate materials this will become the preferred method.

15 The above-described system may be fully automated if, required by the use of automatic loading and unloading magazines at each end, 14 and 15 respectively, of the production line 8. Automation of such a system, using for example a programmable logic controller or PC based control system, is well within the capability of one skilled in the art and will not be discussed further.

20

The photo-luminescent pigment application process will now be described, by way for example only, to illustrate the method of the invention.

- 13 -

A representative piece of substrate is placed on the guide rail close to the empty hopper, then passed into the gap between the bottom orifice of the hopper and the support roller. The position of the hopper assembly is adjusted as necessary to ensure that the bottom orifice lines up with the channels or depressions in the substrate, and there are no gaps to either side that would let powder escape. The
5 hopper is then filled with a thoroughly mixed quantity of the dry powder formulation.

The first piece of "production" substrate is then placed on the guide rail, immediately behind the representative piece of substrate, and moved towards the hopper
10 assembly. In this way it pushes the representative piece of substrate through and passed the hopper assembly and onto the guide rail on the other side of the hopper assembly. The representative piece of substrate can subsequently have the powder that has been applied to it removed by a vacuum cleaning head and then the substrate can be reused as a plug for the hopper's bottom orifice whenever
15 production is halted.

Before the first piece of production substrate is pushed right through the hopper assembly the second piece of production substrate is picked up off a magazine and placed on the guide rail immediately behind the first piece of production substrate.
20 Once the first piece of production substrate is away from the hopper assembly it can be taken off the guide rail and placed on racks ready for oven curing.

The above step is then repeated until the oven racks are full. The racks are placed in the oven for the required curing cycle, then removed from the oven and allowed to cool before final inspection and packaging.

At regular intervals as required the hopper is tapped to remove "rat-holes" in the powder and the hopper is refilled with thoroughly mixed dry powder formulation.

- 5 When the production run has finished the representative piece of substrate can be reused as a plug for the hopper's bottom orifice and finally any left-over powder can be removed from the hopper.

10 It can readily be seen that whereas the above description describes the method of operation for a non-mechanised form of the apparatus the process can readily be automated using the optional automating equipment described above so that the process becomes either semi-automatic or fully automatic. Such automation would be well within the capabilities of the nominally skilled person.

- 15 Where in the foregoing description reference has been made to integers or elements having known equivalents, then such equivalents are herein included as if individually set forth.

Particular examples of the invention have been described and it is envisaged that
20 improvements and modifications can take place without departing from the scope of the appended claims.

CLAIMS

1. A method of applying photo-luminescent pigment to a substrate, said method including:
5 preparing a dry powder formulation comprising, at least, a photo-luminescent pigment and a carrier/fixer;
 depositing the dry powder formulation onto a substrate surface; and,
 heating the dry powder formulation to fuse it to the substrate surface.
- 10 2. A method as claimed in any preceding claim wherein the substrate surface has depressions or channels adapted to receive the dry powder formulation.
3. A method as claimed in claim 2 which further includes applying a light reflecting layer to the substrate surface before depositing the dry powder
15 formulation.
4. A method as claimed in any one of claims 1 to 3 wherein the volume ratio of photo-luminescent pigment to carrier/fixer in the dry powder formulation is such that the fused material exhibits substantially the same strength and
20 durability properties of the carrier/fixer while still exhibiting the photo-luminescent properties of the pigment.
5. A method as claimed in claim 4 wherein the volume ratio is substantially in the range of 1% to 35% photo-luminescent pigment to carrier/fixer.

- 16 -

6. A method as claimed in any preceding claim wherein the dry powered formulation is heated to a temperature recommended by the manufacturer of the carrier/fixer until the formulation is molten.
- 5
7. A method as claimed in claim 6 wherein the formulation is heated to substantially between 160 to 210 degrees centigrade.
8. A method as claimed in claim 6 or claim 7 wherein the formulation is heated
- 10 for approximately 10 to 20 minutes.
9. A method as claimed in any preceding claim wherein after heating the formulation is cooled.
- 15 10. A method as claimed in any preceding claim wherein the carrier/fixer is a heat curable polymer.
11. A method as claimed in any preceding claim wherein the dry powder formulation includes small quantities of additives, such as a de-gassing
- 20 additive, to ensure a smooth surface finish.
12. A method as claimed in any preceding claim wherein the substrate is stamped, extruded or milled aluminium or metal.

13. An apparatus for applying photo-luminescent pigment to a substrate, said apparatus including:
- a hopper adapted to contain a dry powder formulation;
 - one or more orifices adapted to allow transfer of the dry powder formulation from the hopper to a substrate surface; and
 - a guide rail system for locating the substrate surface in both a fixed horizontal plane and a fixed vertical plane below the hopper and orifice.
14. An apparatus as claimed in claim 13 which also includes a heat-curing system for providing enough heat to turn the dry powder formulation into a molten mix.
15. An apparatus as claimed in claim 13 or 14 which also includes a cooling system to cool the molten mix.
16. An apparatus as claimed in any one of claims 13 to 15 which also includes a drive system to move the substrate through the apparatus.
17. An apparatus as claimed in any one of claims 13 to 16 which includes a support roller mounted directly beneath the orifice(s) and hopper to support the substrate.

- 18 -

18. An apparatus as claimed in any one of claims 13 to 17 which includes an adjustable mounting bracket adapted to enable the hopper to be located in the correct position so that the orifice(s) lines up with the substrate.
- 5 19. An apparatus as claimed in any one of claims 13 to 18 wherein the orifice is adapted to communicate snugly with the substrate surface such that the dry powder formulation is deposited substantially only where required.
- 10 20. An apparatus as claimed in any one of claims 13 to 19 which includes a mechanism for tapping the hopper so that any rat-holes in the dry powder formulation are re-filled.
- 15 21. An apparatus as claimed in any one of claims 13 to 20 which includes a brush mounted below the roller, and with its bristles in contact with the roller, so that any powder that falls onto the roller is subsequently brushed off.
22. An apparatus as claimed in any one of claims 13 to 21 wherein the heat-curing system is an oven.
- 20 23. An apparatus as claimed in any one of claims 13 to 21 wherein the heat-curing system is a continuous oven process.
24. An apparatus as claimed in claim 23 wherein the oven includes infra-red heating elements.

25. An apparatus as claimed in any one of claims 13 to 24 which includes an automatic loading and unloading means at each end.
- 5 26. A method of applying photo-luminescent pigment to a substrate as herein described with reference to the examples.
27. An apparatus for applying photo-luminescent pigment to a substrate as herein described with reference to the accompanying drawings.
- 10 28. A substrate bearing photo luminescent material when prepared using a method according to any one of claims 1 to 12 and 26.
29. A substrate bearing photo luminescent material when prepared using an
15 apparatus according to any one of claims 13 to 25 and 27.

1/3

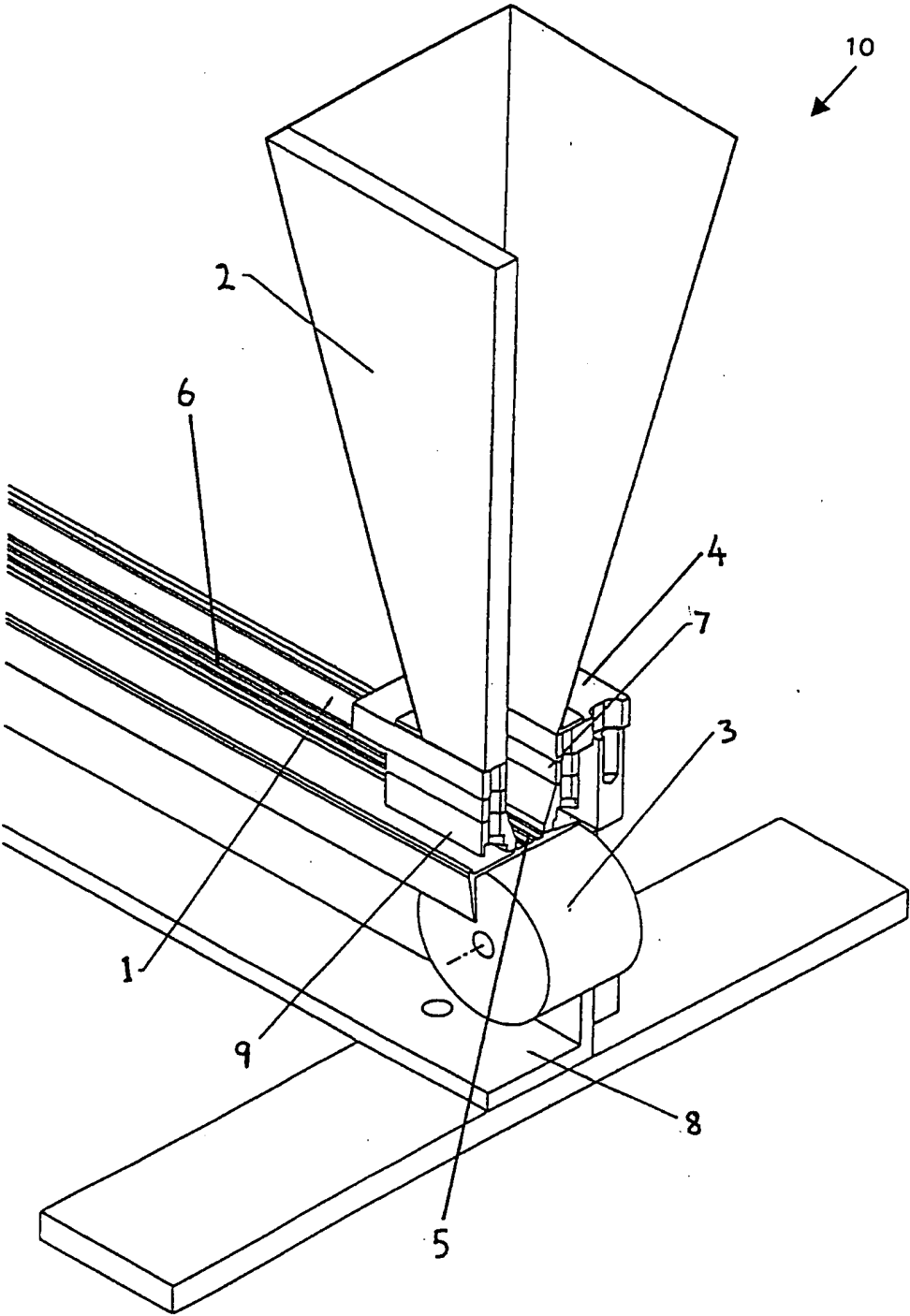


FIGURE 1

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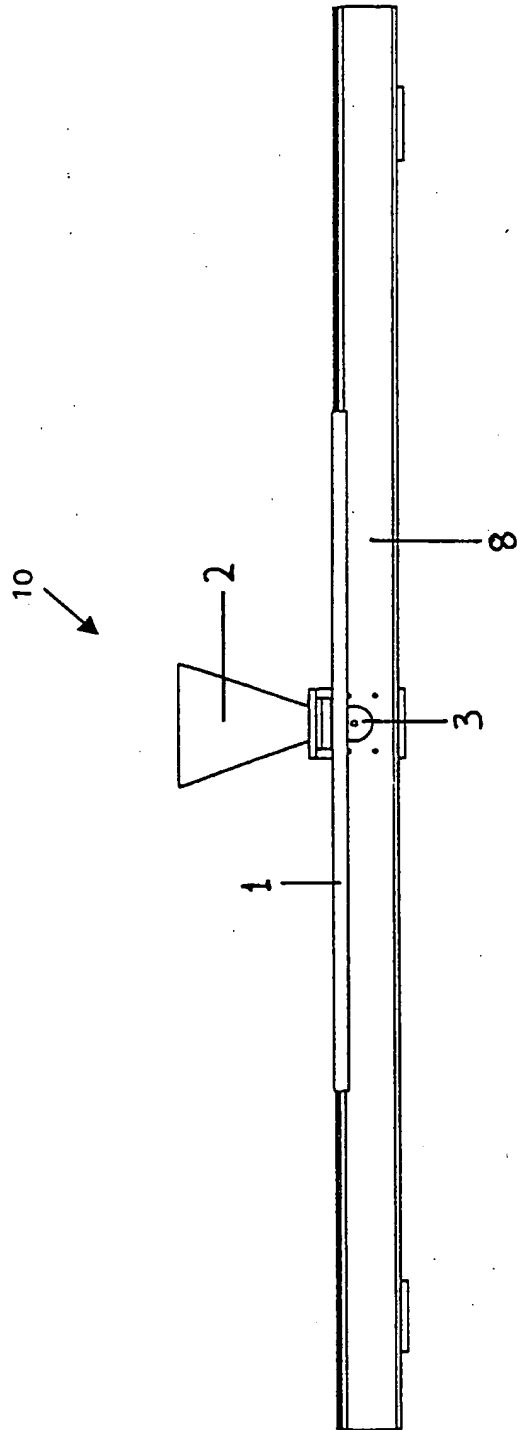


FIGURE 2

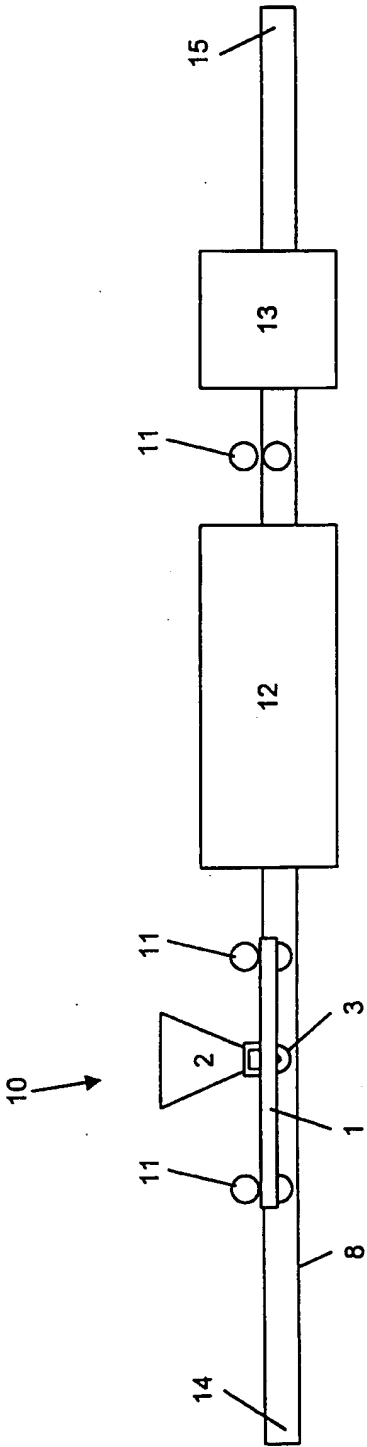


FIGURE 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ00/00127

A. CLASSIFICATION OF SUBJECT MATTER		
Int. Cl. ⁷ : B05D 5/06, B05C 19/04		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) IPC B05C, B05D, C23C		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU: B05D 19/04, C23C 10/28, 10/30		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) DWPI: See extra sheet for search terms		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5897738 A (RAJAN et al) 27 April 1999 See whole document	1-12, 26, 28
A	Derwent abstract Accession No. 95-012049/02 Class A82 G02 (A17) JP 06299099 A (SUMITOMO SEIKA CHEM CO LTD) 25 October 1994 Abstract	1-12, 26, 28
A	US 5639514 A (JONES et al) 17 June 1997 See whole document	13-25, 27, 29
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 26 October 2000		Date of mailing of the international search report - 7 NOV 2000
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929		Authorized officer DEREK BUTLER Telephone No : (02) 6283 2347

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ00/00127

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5192027 A (DELMER et al) 9 March 1993 See whole document	13-25, 27, 29

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ00/00127

Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos :
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos :
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos :
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See extra sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ00/00127**Supplemental Box**

(To be used when the space in any of Boxes I to VIII is not sufficient)

Continuation of Box No: II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the International Searching Authority has found that there are different inventions as follows:

1. Claims 1-12, 26 and 28 are directed to a method of applying photo-luminescent pigment to a substrate by preparing a dry powder formulation having at least a photo-luminescent pigment and a carrier/fixer, depositing the formulation onto a substrate and heating the formulation to fuse it to the substrate. It is considered that combination of steps comprises a first "special technical feature".

2. Claims 13-25, 27 and 29 are directed to an apparatus suitable for applying photo-luminescent pigment to a substrate having a hopper to contain a dry powder formulation, an orifice or orifices to transfer the formulation to the substrate surface and a guide system to locate the substrate below the hopper. It is considered that hopper and guide system comprises a second "special technical feature".

These groups are not so linked as to form a single general inventive concept, that is, they do not have any common inventive features, which define a contribution over the prior art. The common concept linking together these groups of claims is depositing photo-luminescent pigment onto a substrate. However this concept is not novel in the light of US 5897738. Therefore these claims lack unity a posteriori.

B. FIELDS SEARCHED

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI: Search terms: luminescent, phosphorescent, fluorescent, powder, particle, dust, pulverised, particulate, particle, coat, cover, layer, heat, fuse, bake, oven, kiln, hot melt, molten, substrate, aluminium, metal, stair, walkway, floor, rail, strip, hopper, bin, chute, feed, supply, guide, locate, move, transfer, pass, B05C, B05D, C23C

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/NZ00/00127

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
US	5897738	AU	64955/96	CA	2230853	EP	847335
		WO	9707982				
JP	06299099	NIL					
US	5192027	AU	32918/93	FR	2691669		
US	5639514	AU	45104/93	BR	9306701	EP	648150
		NZ	253770	SG	46234	WO	9401224
END OF ANNEX							